



Biological Assessment Report

Middle Fork Black River Reynolds County, Missouri

Fall 2016 – Spring 2017

Prepared for:
Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

Prepared by:
Missouri Department of Natural Resources
Division of Environmental Quality
Environmental Services Program
Water Quality Monitoring Section

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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MoDNR**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a macroinvertebrate biological assessment and habitat study of Middle Fork Black River during the fall of 2016 and spring of 2017. Fall sampling was conducted on September 21-22, 2016, and consisted of macroinvertebrate sampling, stream habitat assessments, water quality sampling, and sediment sampling. During the spring, sampling was conducted on March 15, 2017, and consisted of macroinvertebrate sampling and water quality sampling at the same study stations. Sampling was conducted by Brandy Bergthold, Brian Nodine, Raissa Espejo, and Dave Gullic.

Middle Fork Black River, water body identification (**WBID**) number 2744, is classified as a Class P stream in the Missouri Water Quality Standards (**WQS**) (MoDNR 2014). Middle Fork Black River has the following designated uses: irrigation, livestock and wildlife watering; protection of warm water aquatic life and human health-fish consumption; cool water fisheries habitat; category A whole body contact recreation; and secondary contact recreation. A Class P stream is defined as a stream that maintains permanent flow even in drought periods. Category A whole body contact applies to waters designated as public swimming and recreational use areas. Middle Fork Black River is not on the 303(d) List of Impaired Waters.

In the 1960s, mining activity in Missouri shifted from the Old Lead Belt to an area known as the Viburnum Trend (New Lead Belt) located in Crawford, Washington, Iron, Dent, Reynolds, and Shannon counties (Poulton et al. 2010). Studies conducted by the U.S. Geological Survey (Allert et al. 2008, Allert et al. 2009, Poulton et al. 2010) have shown aquatic life effects in watersheds that include mining activities in the Viburnum Trend in southeast Missouri. Studies have indicated the aquatic macroinvertebrates of Middle Fork Black River are impaired due to metals toxicity from mining activities within the watershed (Allert et al. 2008, Poulton et al. 2010). Brumbaugh et al. (2007) assessed metals contamination of the New Lead Belt and found high metals concentrations in several streams, including Strother Creek. This current bioassessment study focused on Middle Fork Black River from the confluence with West Fork Black River, upstream to the confluence of Strother Creek. Strother Creek is directly affected by mining activities.

Missouri does not currently have numeric water quality criteria for the protection of aquatic life from metals toxicity in stream sediment. Probable Effect Concentrations (**PECs**) suggested by MacDonald et al. (2000) are used for assessing compliance of metals toxicity with narrative general criteria. PECs are concentrations at which toxic effects to aquatic life are likely to occur.

2.0 Sampling Locations and Study Area

Middle Fork Black River is located within the Ozark/Black/Current Ecological Drainage Unit (EDU) (Figure 1). An EDU is a region in which biological communities and habitat conditions can be expected to be similar.

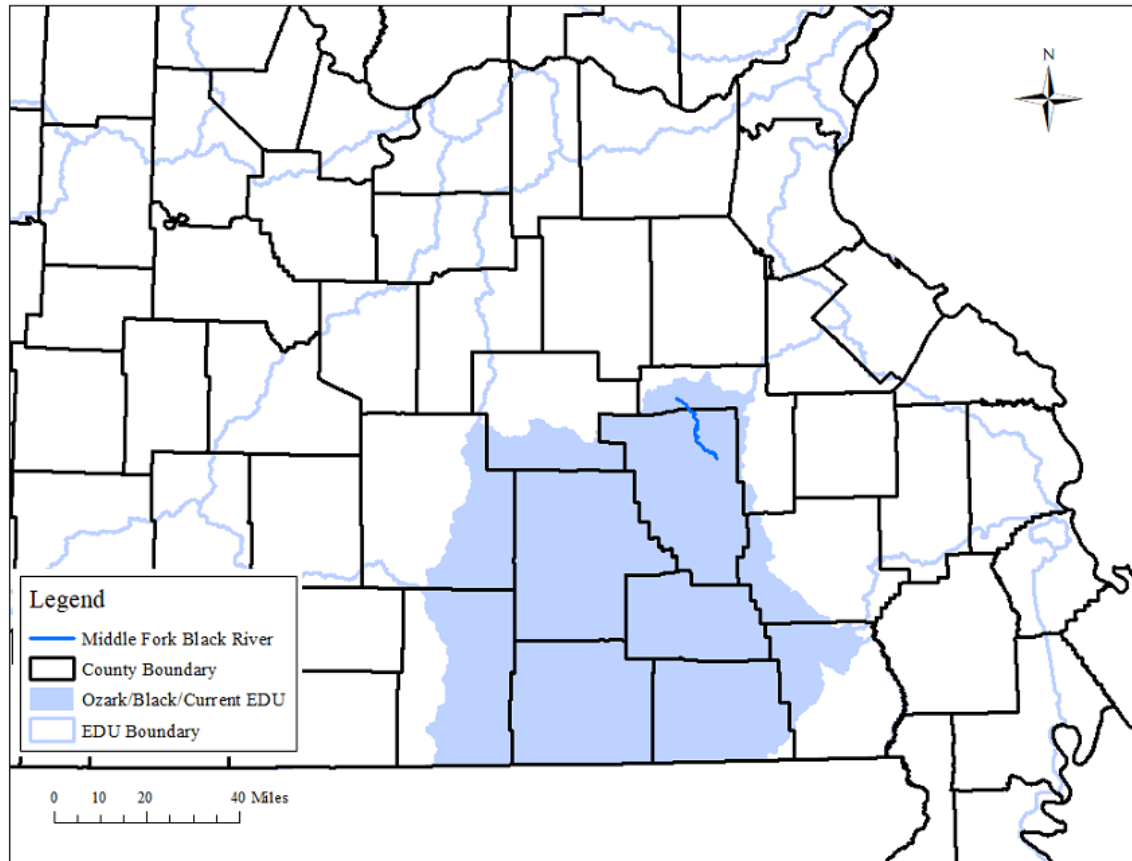


Figure 1. Location of Middle Fork Black River within the Ozark/Black/Current EDU.

Four stations were sampled. Station locations and descriptions are listed below and shown in Figure 2. All sampling stations were located in Universal Transverse Mercator (UTM) Zone 15 and were located in Reynolds County.

Sampling Locations

Middle Fork Black River Station 1 (**MFB1**), SE 1/4, SE 1/4 Sect. 2, T. 32 N., R.01 E., was sampled downstream of State Highway 72/21. UTM coordinates collected at the upstream boundary of the sample reach are UTMN 4150046, UTME 685445.

Middle Fork Black River Station 2 (**MFB2**), SE 1/4, NW 1/4 Sect. 27, T. 33 N., R. 01 E., was accessed from private property adjacent to County Road 814. The UTM coordinates at the downstream boundary of the sampling reach are UTMN 4154851, UTME 682484.

Middle Fork Black River Station 3 (**MFB3**), SE1/4, NW 1/4 Sect. 10, T. 33 N., R. 01 E., was accessed from private property adjacent to State Highway 49. The UTM coordinates at the downstream boundary of the sampling reach are UTMN 4160004, UTME 683165.

Middle Fork Black River Station 4 (**MFB4**), NE 1/4 NE 1/4, S. 05, T. 33 N., R. 01 E., was sampled approximately 0.4 miles downstream of County Road 818. The UTM coordinates at the downstream boundary of the sampling reach are UTMN 4163164, UTME 680643.

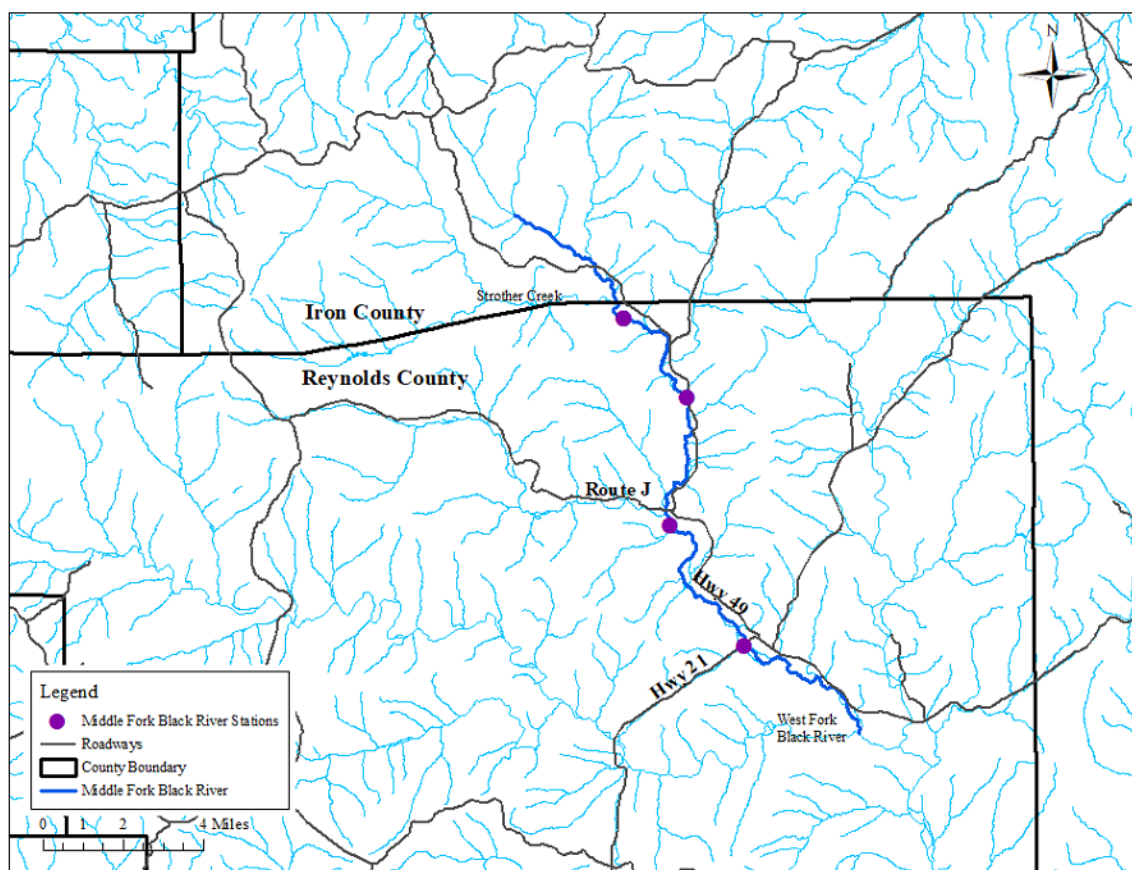


Figure 2. Middle Fork Black River Sampling Locations

Table 1 compares the land cover percentages from the Ozark/Black/Current EDU and the 12-digit Hydrologic Unit Code (**HUC**) containing the study stations on Middle Fork Black River. Percent land use data were derived from Thematic Mapper satellite images from 2000-2004 and interpreted by the Missouri Resource Assessment Partnership (Sowa et al. 2004).

Table 1. Percent Land Use of Study Stations and the Ozark/Black/Current EDU

Stations/Land Use	MFB1&MFB2	MFB3	MFB4	Ozark/Black/ Current EDU
HUC-12 110100070-	-306	-305	-303	
Urban/Impervious	2.8	0.7	0.5	1.3
Cropland	0.8	0.1	0.2	0.9
Grassland	8.3	7.8	6.7	23.6
Forestland	82.4	85.2	87.9	68.8
Herbaceous	3.5	4.7	4.0	3.5
Wetland/Open Water	2.4	1.4	0.8	1.6

Comparison of land use between the 12-digit HUC containing the study segments and the Ozark/Black/Current EDU showed that overall, the study stream's watersheds contained less grassland and more forested land than the EDU.

3.0 Objectives

The primary objective of this study was to determine if Middle Fork Black River supports the protection of warm water aquatic life beneficial use designation based on biological criteria calculated from reference stream macroinvertebrate data in the Ozark/Black/Current EDU.

The macroinvertebrate community and instream habitat were compared to biological criteria reference (**BIOREF**) stream data from the Ozark/Black/Current EDU. Water quality parameters were compared with Missouri's WQS (MoDNR 2014) and United States Environmental Protection Agency's (**U.S. EPA**) ambient water quality criteria recommendations for nutrients (U.S. EPA 2000). Sediment toxicity was compared with MacDonald's recommended PECs for metals toxicity (MacDonald et al. 2000).

3.1 Null Hypotheses

- 1) Stream habitat assessment scores of Middle Fork Black River study sites will be similar to those of Sinking Creek, a BIORREF station located in the Ozark/Black/Current EDU.
- 2) The macroinvertebrate community in Middle Fork Black River will be similar to the macroinvertebrate community of BIORREF streams in the Ozark/Black/Current EDU.
- 3) Physicochemical water quality of Middle Fork Black River will meet the WQS and meet U.S. EPA's recommended nutrient levels.
- 4) Metals toxicity values of sediment samples collected from Middle Fork Black River will meet recommended PEC values calculated by MacDonald et al. (2000).

4.0 Methods

4.1 Stream Habitat Assessment Project Procedure

Standardized assessment procedures were followed as described for riffle/pool prevalent streams in the Stream Habitat Assessment Project Procedure (**SHAPP**, MoDNR 2016k). According to the SHAPP, an aquatic community is influenced by the quality of the stream habitat. Stream habitat quality is scored for each station, and the scores are compared with a control stream (BIOREF reach) SHAPP score. If the SHAPP score at a study station is $\geq 75\%$ of the SHAPP control score, the stream habitat at the study station is considered to be comparable to the control stream. Sinking Creek, a BIOREF station located south of Annapolis in Reynolds County, Missouri, was chosen as the SHAPP control. The habitat assessment of the BIOREF stream was conducted on September 22, 2016. SHAPP scores were calculated for the study stations, compared to the Sinking Creek BIOREF station, and examined for irregular results.

4.2 Macroinvertebrate Sampling and Analyses

Macroinvertebrate sampling was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**, MoDNR 2012). Middle Fork Black River is considered a riffle/pool dominated system. The three standard habitats sampled at all locations were flowing water over coarse substrate, non-flowing water over depositional substrate, and submerged rootmat. Macroinvertebrate samples were subsampled in the laboratory and identified to specific taxonomic levels (MoDNR 2016h) to develop biological metric values (MoDNR 2012).

Reference streams within the EDU represent the best available conditions and are the basis for calculating Macroinvertebrate Stream Condition Index (**MSCI**) scores. Middle Fork Black River macroinvertebrate data were evaluated relative to BIOREF streams in the Ozark/Black/Current EDU. Biological criteria are calculated separately for the fall (mid-September through mid-October) and spring (mid-March through mid-April) index periods. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric MSCI. The four components of the MSCI are Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered fully supporting, 10-14 partially supporting, and 4-8 non-supporting of the protection of warm water aquatic life beneficial use designation as listed in the WQS (MoDNR 2014).

Poulton et al. (2010) incorporated additional metrics to analyze metals pollution in mining streams of the Viburnum Trend in Missouri, including percent dominant taxon, the ratio of tolerant to intolerant Ephemeroptera, percent scrapers, and the percent Chironomidae. Intolerant Ephemeroptera were defined as those with a BI value less than five.

4.3 Physicochemical Water Sampling and Sediment Analyses

Physicochemical water samples were handled according to the appropriate MoDNR ESP Standard Operating Procedure (SOP). Results for physicochemical water parameters were examined by season and station by *in situ* field measurements or grab samples collected in accordance with the SOP MDNR-ESP-001, *Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* (MoDNR 2016a). All samples were kept on ice during transport to ESP.

Water quality parameters were measured *in situ* or collected and returned for analyses at the ESP laboratory in Jefferson City. Turbidity (NTU, MoDNR 2016c) was measured in the ESP, WQMS biology laboratory. Discharge (cubic feet per second-cfs, MoDNR 2015), DO (mg/L, MoDNR 2016g), specific conductance ($\mu\text{S}/\text{cm}$, MoDNR 2016f), pH (MoDNR 2016d), and temperature ($^{\circ}\text{C}$, MoDNR 2016e), were measured in the field. The ESP Chemical Analysis Section conducted analyses for the following: nitrate+nitrite-nitrogen, total nitrogen, total phosphorus, ammonia as N, sulfate, chloride, TSS/non-filterable residue, dissolved calcium, and dissolved magnesium (all parameters reported in mg/L). The ESP Chemical Analysis Section also conducted analyses for dissolved metals (barium, cadmium, lead, nickel, zinc), reported in $\mu\text{g}/\text{L}$.

Sediment was collected in accordance with SOP MDNR-ESP-011, *General Sampling Considerations for Chemical Analysis of Sediment* (MoDNR 2016b). Total metals analysis (arsenic, cadmium, copper, lead, nickel, and zinc) was conducted by the ESP Chemical Analysis Section and reported in $\mu\text{g}/\text{kg}$.

4.4 Discharge

Stream discharge was measured using a SonTek/YSI FlowTracker Handheld Acoustic Doppler Velocimeter at all stations during both sampling seasons in accordance with the SOP MDNR-ESP-113, *Flow Measurements in Open Channels* (MoDNR 2015).

4.5 Quality Assurance/Quality Control (QA/QC)

4.5.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with *Quality Control Procedures for Checking Water Quality Field Instruments* (MoDNR 2016i).

4.5.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the SMSBPP document (MoDNR 2012).

4.5.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with *Quality Control Procedures for Data Processing* (MoDNR 2016j).

4.5.4 Duplicate Sample Collection

Duplicate samples are collected at two randomly selected sampling stations per season for macroinvertebrates and for 10 percent of water samples. Duplicate samples are obtained from the same location at essentially the same time as the true sample following the same procedures in accordance with *Quality Assurance/Quality Control for Environmental Data Collection* (MoDNR 2013). The true samples and the duplicate samples are analyzed for the same set of parameters and reported independently. A duplicate is used to assess the precision associated with sampling methodology, sample heterogeneity, and analytical procedures (MoDNR 2013). Duplicate macroinvertebrate samples are analyzed for Quantitative Similarity Index for Taxa (**QSIT**), which compares the two samples in terms of presence or absence of taxa and taking relative abundance (percent composition) of each taxon into account (MoDNR 2012). Duplicate macroinvertebrate samples are expected to have a 70 percent or greater taxa similarity (Rabeni et al. 1999; MoDNR 2012). A duplicate sample was collected for both macroinvertebrate and physicochemical parameters from Middle Fork Black Station 4 during the spring sampling period.

5.0 Results

5.1 Stream Habitat Assessment

Habitat assessment scoring results are found in Table 2. If the Middle Fork Black River SHAPP scores are $\geq 75\%$ of the control station score, the stations are considered to contain comparable habitats to the control station. All stations scored $\geq 75\%$ of the SHAPP control station at Sinking Creek. Based on SHAPP scores, it is inferred that the study stations have habitats similar to the BIOREF stream and should, therefore, support a comparable biological community.

Table 2. Habitat Values and Scores from Stream Habitat Assessments,
Middle Fork Black River and the BIOREF, Sinking Creek

Stream Habitat Parameters	MFB1	MFB2	MFB3	MFB 4	Sinking Cr.
Habitat Assessment Date	9/21/16	9/21/16	9/22/16	9/22/16	9/22/16
Epifaunal Substrate	II(15)	I(16)	II(15)	I(20)	I(18)
Embeddedness	I(16)	I(16)	I(18)	I(16)	I(16)
Velocity/Depth Regime	I(20)	I(16)	I(17)	I(20)	I(20)
Sediment Deposition	III(9)	IV(4)	II(12)	II(12)	II(12)
Channel Flow Status	II(14)	III(9)	II(15)	II(12)	II(11)
Channel Alteration	I(19)	I(16)	I(20)	I(20)	I(20)
Riffle Quality	I(16)	II(15)	II(14)	II(13)	I(17)
Left Bank Stability	III(5)	II(7)	II(8)	III(5)	I(10)
Right Bank Stability	I(9)	I(9)	I(9)	I(10)	I(9)
Left Bank Vegetative Protection	IV(1)	IV(1)	IV(I)	IV(1)	IV(1)
Right Bank Vegetative Protection	IV(1)	IV(2)	IV(I)	IV(2)	IV(2)
Left Bank Riparian Zone Width	III(5)	I(9)	I(9)	I(9)	I(10)
Right Bank Riparian Zone Width	II(8)	I(9)	I(10)	I(10)	I(10)
Total Habitat Score	138	129	149	150	156
Percentage of the BIOREF	88	83	95	96	--

Habitat parameter categories range from I to IV with category I = optimal, category II = suboptimal, category III = marginal, and category IV = poor. Habitat parameter scores are listed in parentheses and range from 0 to 20 except for vegetative protection and riparian zone categories, which range from 0 to 10.

Middle Fork Black River Stations 1 and 2 consisted of wide braided channels with very large gravel bars. Station 3 transitioned into an area dominated by large expanses of bedrock and little to no gravel bars along the stream banks. Station 4 shifted back to a channel dominated by cobble and gravel with gravel bars present.

Stations 2 and 4 had optimal epifaunal substrate with cobble, large gravel, and submerged debris instream. Station 1 had less cobble-sized substrate, and station 3 was dominated by bedrock with pockets of gravel and cobble. Embeddedness as well as the velocity/depth regimes were optimal at all sampling stations. Sediment deposition increased at the downstream stations. Channel flow status ranked marginal at station 3 and was suboptimal at the other stations. Channel alterations were minimal. Station 2 had a short stream reach adjacent to the county road where rip rap had been placed to mitigate stream bank erosion. Riffle quality was optimal at station 1 but ranked suboptimal at stations 2, 3, and 4 due to the riffle length not extending two times the riffle width. At all stations, bank stability was better along one bank. Although vegetative protection along the banks was low, the stations mostly had well-established riparian corridors with a mix of trees and understory growth. The riparian area at station 1 ranked lower than the other stations.

Part of the stream at this station lacked trees in the riparian area due to pastureland adjacent to the stream.

Sinking Creek, the SHAPP control, contained optimal epifaunal substrate. The substrate consisted mostly of cobble and gravel with instream woody debris and leaf litter. There was little sediment deposition evident, and optimal velocity/depth regimes were present. Channel flow status was comparable to the study stations on Middle Fork Black River, filling approximately 75% of the channel. Although vegetative protection along the banks was minimal, the stream banks had little active erosion. The riparian area along Sinking Creek was optimal.

5.2 Biological Assessment and Macroinvertebrate Community Analyses

Tables 3 and 4 provide scoring criteria and results for the fall and spring index periods. MSCI scores were calculated by scoring study station biological metrics using the appropriate BIOREF criteria. An MSCI score of 16-20 is considered fully supporting, 10-14 is partially supporting, and 4-8 is considered non-supporting of the beneficial use designation. All stations had fully supporting MSCI scores during both sampling seasons.

Table 3. Fall 2016 Metric Values and Scores for Middle Fork Black River
Using Ozark/Black/Current Biological Criteria

Stations	TR	EPTT	BI	SDI	MSCI	Support
MFB1	80	30	5.6	3.37		
Score	3	5	3	5	16	Full
MFB2	90	31	5.5	3.26		
Score	5	5	3	3	16	Full
MFB3	88	27	5.5	3.71		
Score	5	5	3	5	18	Full
MFB4	87	30	5.1	3.52		
Score	5	5	5	5	20	Full
BIOREF Score=5	>85	>25	<5.2	>3.28	20-16	Full
BIOREF Score=3	85-43	25-13	5.2-7.6	3.28-1.64	14-10	Partial
BIOREF Score=1	≤43	≤13	≥7.6	≤1.64	8-4	Non

MSCI Scoring Table (in light gray) developed from BIOREF streams ($n = 23$). TR=Taxa Richness; EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index.

Table 4. Spring 2017 Metric Values and Scores for Middle Fork Black River
Using Ozark/Black/Current Biological Criteria

Stations	TR	EPTT	BI	SDI	MSCI	Support
MFB1	87	33	5.3	3.56		
Score	3	5	5	5	18	Full
MFB2	98	38	5.5	3.57		
Score	5	5	3	5	18	Full
MFB3	103	36	5.2	3.62		
Score	5	5	5	5	20	Full
MFB4a	98	33	5.1	3.56		
Score	5	5	5	5	20	Full
MFB4b	102	40	5.3	3.52		
Score	5	5	5	5	20	Full
BIOREF Score=5	>93	>31	<5.4	>3.37	20-16	Full
BIOREF Score=3	93-47	31-15	5.4-7.7	3.37-1.69	14-10	Partial
BIOREF Score=1	≤47	≤15	≥7.7	≤1.69	8-4	Non

MSCI Scoring Table (in light gray) developed from BIORREF streams ($n = 22$). TR=Taxa Richness; EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index.

The fall 2016 macroinvertebrate community analysis is shown in Table 5. The total percentage of EPT taxa at the study stations ranged from 37.9 percent to 58.0 percent (compared to the BIORREF average of 43.1 percent). Ephemeroptera and Trichoptera were common at all stations. Trichoptera taxa were present in higher abundance than the BIORREF average at stations 2, 3, and 4. Plecoptera were also present at all stations but made up <0.1 percent of the macroinvertebrate community at stations 2 and 3.

Coleoptera taxa ranged from 19.1 percent to 35.4 percent at the study stations, compared to 18.3 percent of the BIORREF samples. The coleopteran family Elmidae was the most common family collected at stations 2 and 4 and the second most common family collected at stations 1 and 3. The elmid *Stenelmis* was the most common taxon at all four study stations. Dipteran taxa ranged from 12.8 percent to 30.2 percent compared to the BIORREF average of 17.1. The dipteran family Chironomidae was prevalent at all sampling stations. Although Chironomidae were dominant at stations 1 and 3, no single taxon dominated the community. Heptageniidae was the second most common family collected at station 4 and consisted mostly of *Maccaffertium pulchellum*, *M. mediopunctatum*, and *Stenonema femoratum*.

Table 5. Fall 2016 Macroinvertebrate Community Analysis

Stations	BIOREF Average	MFB1	MFB2	MFB3	MFB4
Variables					
% Ephemeroptera	35.2	29.2	21.8	31.2	35.5
% Plecoptera	0.8	1.3	<0.1	<0.1	0.2
% Trichoptera	7.1	7.4	19.7	16.3	19.5
% Total EPT	43.1	37.9	41.6	47.6	58.0
% Coleoptera	18.3	28.5	35.4	19.1	25.3
% Diptera	17.1	30.2	18.2	25.4	12.8
% Dominant Macroinvertebrate Families					
Chironomidae	15.3	28.9	16.7	24.1	11.8
Elmidae	15.3	28.1	34	17.0	23.3
Baetidae	3.1	11.6	5.7	6.9	5.0
Caenidae	9.5	7.0	3.1	8.0	7.5
Leptohyphidae	5.1	5.6	3.0	2.3	2.9
Hydropsychidae	3.4	4.3	11.0	6.9	11.4
Heptageniidae	10.9	3.4	5.4	9.0	13.3
Leptoceridae	1.4	1.8	6.4	6.3	4.3
Isonychiidae	4.7	1.6	3.2	3.8	4.3

The top two families of the study stations are shown in bold.

During the fall, taxa with BI values ≥ 5.0 (more tolerant) ranged from 64 percent to 81 percent of study stream samples (Figure 3). In comparison, BIORREF streams contained 59 percent of taxa within the same category. Taxa with BI values < 5.0 (more sensitive) ranged from 19 percent to 36 percent, compared to BIORREF streams, in which the more sensitive taxa composed an average of 41 percent of samples.

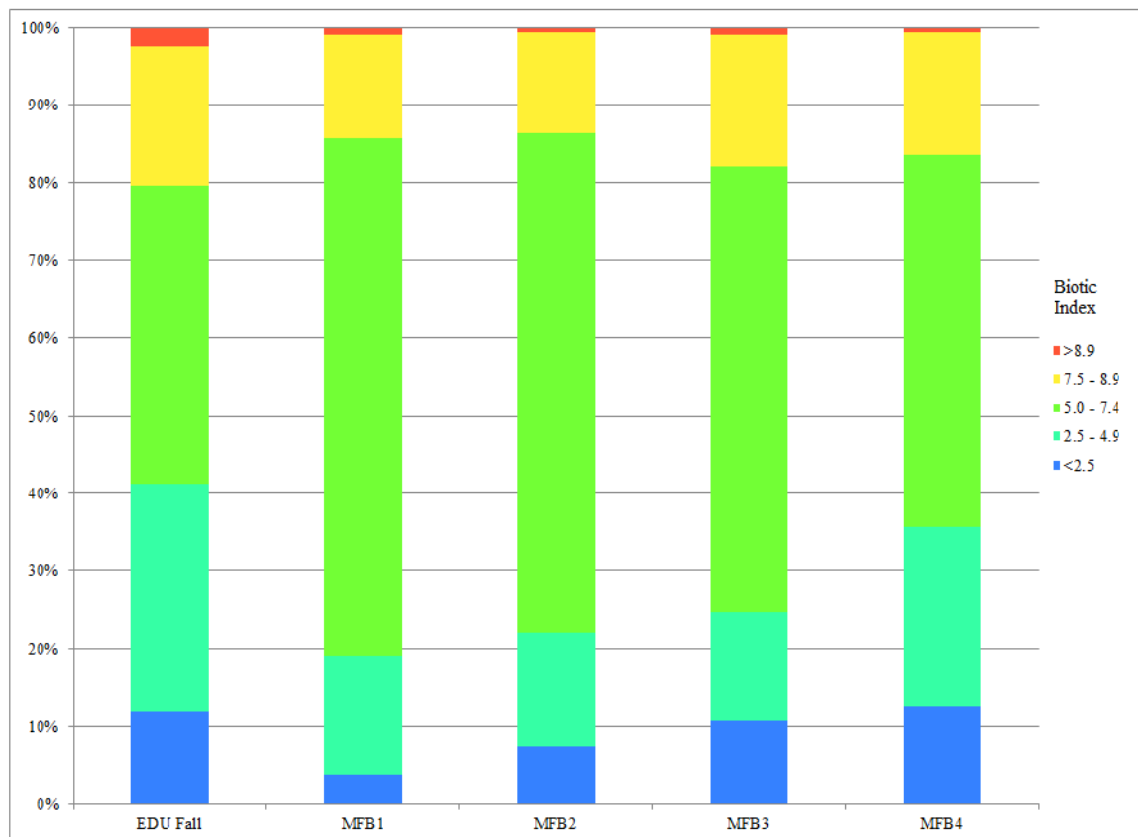


Figure 3. Fall 2016 Percent Taxa by Biotic Index Range

The spring 2017 macroinvertebrate community analysis is shown in Table 6. The total percentage of EPT taxa at the study stations ranged from 23.6 percent to 42.9 percent (compared to the BIOREF average of 41.4 percent). EPT taxa were present at all stations. Ephemeroptera abundance varied at the study stations. Plecoptera were less abundant at the downstream stations, and Trichoptera taxa were common at all of the study stations.

Dipteran taxa ranged from 44.6 percent to 63.7 percent compared to the BIOREF average of 41.8. The dipteran family Chironomidae was the most prevalent dipteran at all study stations, ranging from 42.1 to 59.8 percent of the macroinvertebrate community. The chironomid *Cricotopus/Orthocladius* was the most common taxon collected, ranging from 12 percent of the sample at station 3 to 17 percent of the sample at station 4a. The order Coleoptera was the second dominant family at stations 1, 2, and 4a, but it was collected in lesser abundance than in the fall. Coleoptera taxa ranged from 4.7 percent to 10 percent at the study stations, and 9.3 percent at the BIOREF samples. The coleopteran family Elmidae was again the most common beetle family collected. The elmid *Optioservus sandersoni* was more commonly collected than *Stenelmis* during the spring sampling. Hydropsychidae was the second most common taxa group collected at station 3 and consisted of *Cheumatopsyche* and *Ceratopsyche morosa* grp. Heptageniidae was the second most common family at station 4b and contained seven different taxa.

Table 6. Spring 2017 Macroinvertebrate Community Analysis

Stations	BIOREF Average	MFB1	MFB2	MFB3	MFB4a	MFB4b
Variables						
% Ephemeroptera	22.8	16.4	7.8	21.9	15.4	15
% Plecoptera	5.5	2.5	3.4	4.3	5.3	5.8
% Trichoptera	5.1	11.3	12.4	16.7	12.2	8.8
% Total EPT	33.4	30.2	23.6	42.9	32.9	29.6
% Coleoptera	9.3	10	9	7.5	5.8	4.7
% Diptera	41.8	55.9	63.7	44.6	54.5	62
% Dominant Macroinvertebrate Families						
Chironomidae	37.6	53.5	59.8	42.1	50.5	58.7
Elmidae	7.9	10	8.7	7.2	5.7	4.5
Ephemerellidae	5.4	7.6	2.6	2.7	1.4	1
Hydropsychidae	1.9	5.8	5.3	11.8	4.5	3.1
Heptageniidae	7.3	5.1	1.7	10.2	5.4	6.4
Hydracarina	2.4	2.7	1.3	0.9	3.9	1.8
Hydroptilidae	0.4	2.6	4.1	1.3	2.7	2
Isonychiidae	1.9	1.1	2.0	5.3	2.8	3.5
Leuctridae	3.2	0.5	2.1	2	4.2	3.8

The top two families of the study stations are shown in bold.

During the spring, taxa with BI values ≥ 5.0 (more tolerant) ranged from 65 percent to 75 percent of the samples from the study streams (Figure 4). In comparison, BIORREF streams contained 60 percent of taxa within the same category. Taxa with BI values < 5.0 (more sensitive) ranged from 25 percent to 35 percent, compared to BIORREF streams in which more sensitive taxa composed an average of 40 percent of samples.

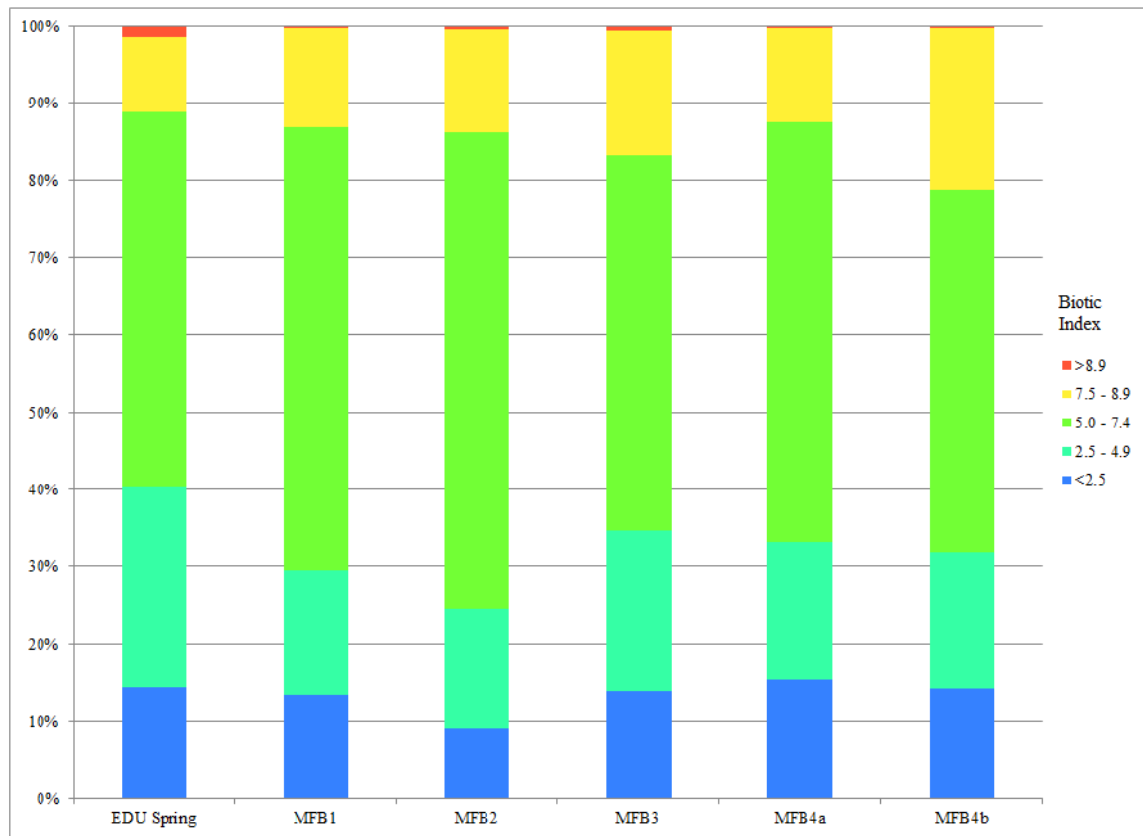


Figure 4. Spring 2017 Percent Taxa by Biotic Index Range

5.2.1 Additional Metrics to Analyze Metals Pollution

Percent Dominant Taxa

Percent of a single dominant taxon is expected to increase in response to mining related disturbances (Poulton et al. 2010). The percent dominance of a single taxon ranged from 9.7 percent to 24.8 percent (Figure 5). The percent dominant taxon was highest at station 2, and the dominant taxon at all stations during the fall was *Stenelmis*. During the spring, dominant taxa ranged from 12.1 percent to 16.5 percent and consisted of two taxa: *Cricotopus/Orthocladius* at stations 1, 2, 3, and 4a and *Dicrotendipes* at station 4b. The percent dominant taxon was highest at one of the duplicate samples at station 4 (4a).

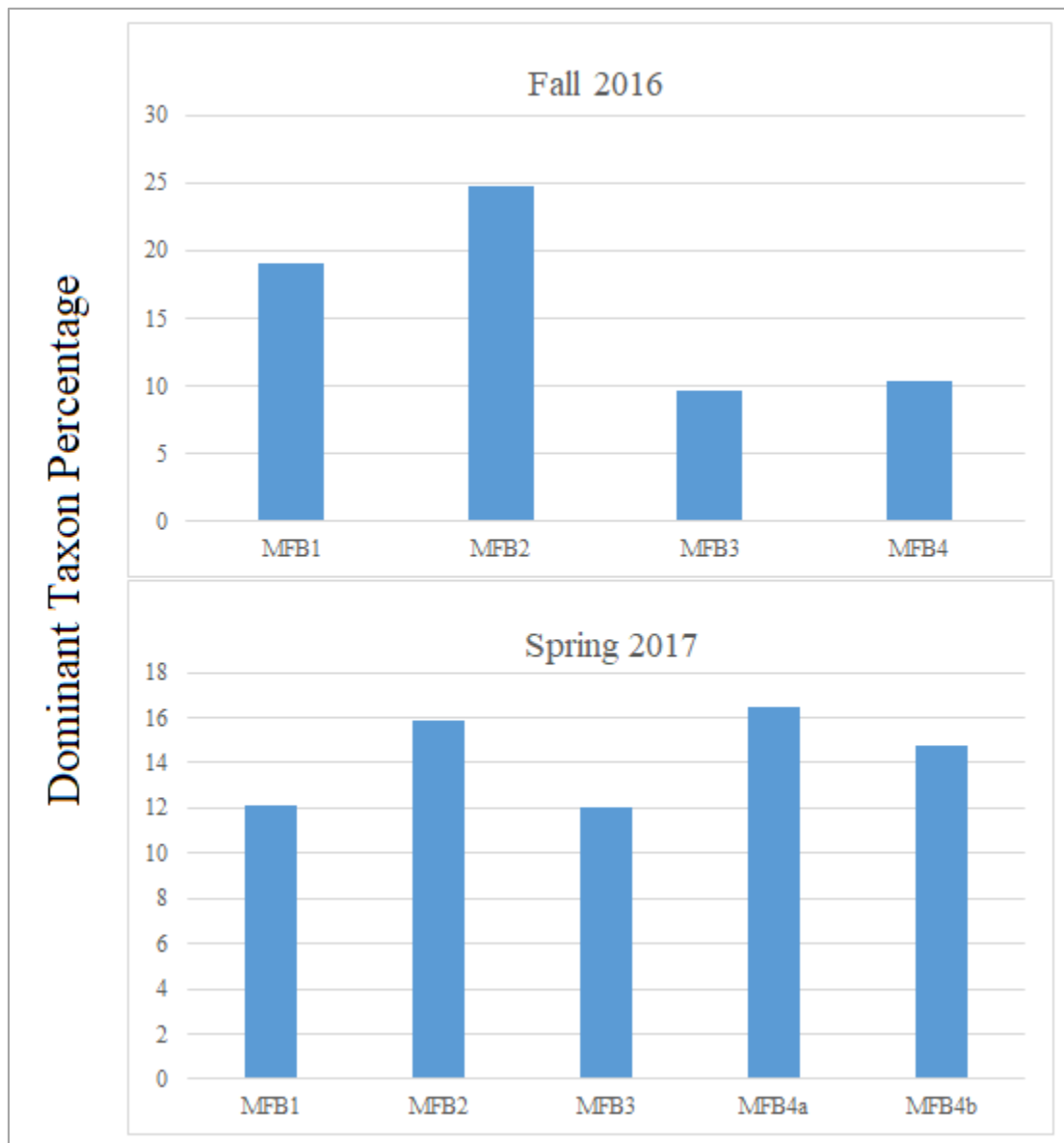


Figure 5. Dominant Taxon Percentage

Ratio of tolerant to intolerant Ephemeroptera

The ratio of tolerant to intolerant mayflies is expected to increase in response to mining related disturbances (Poulton et al. 2010). The ratio of tolerant to intolerant Ephemeroptera was highest at station 1 during the fall. During the spring, the ratio was highest at station 2 (Figure 6).

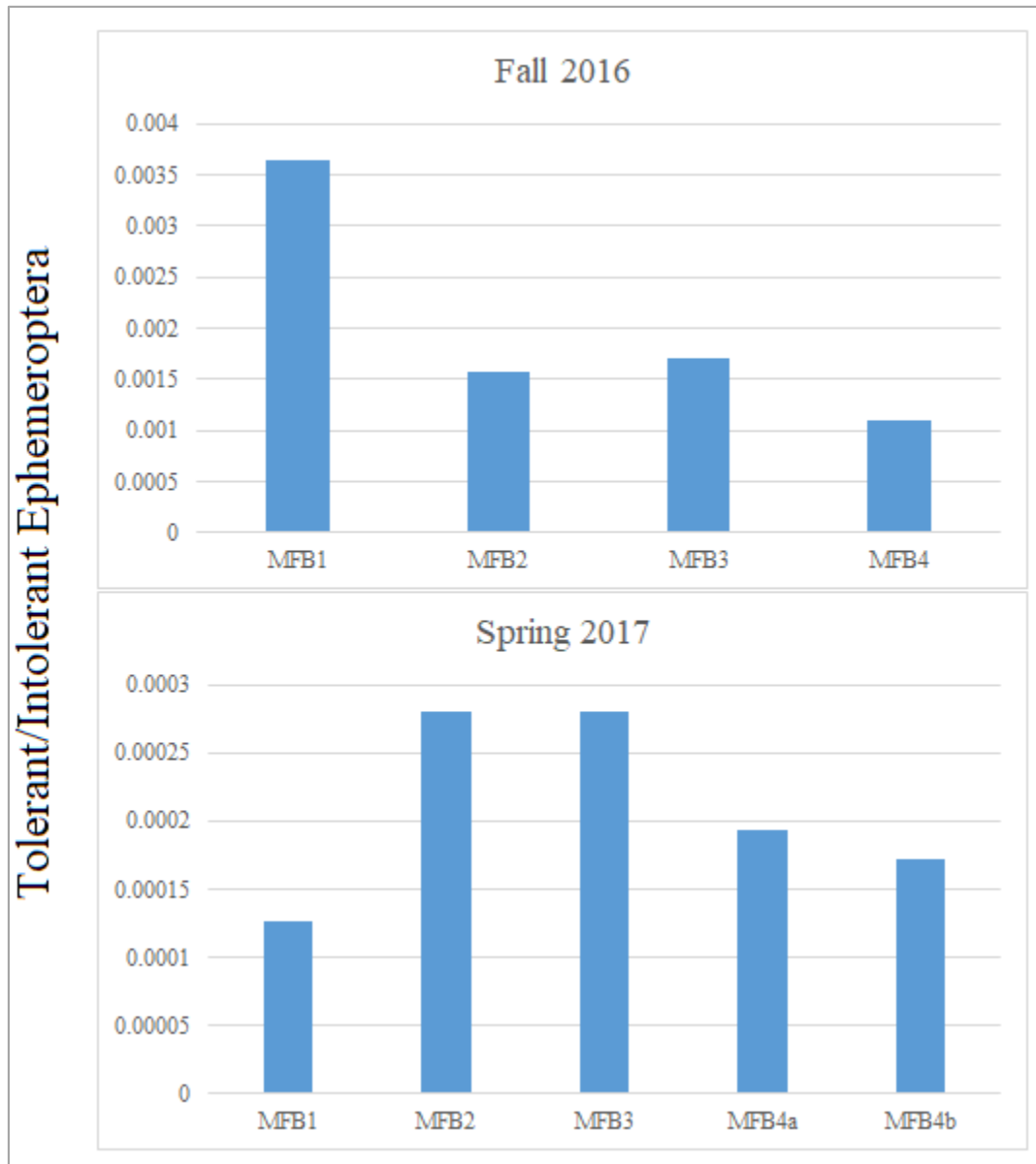


Figure 6. Tolerant/Intolerant Ephemeroptera

Percent scrapers

The percent of the functional feeding group scrapers is expected to decrease in response to mining activities (Poulton et al. 2010). Percent scrapers ranged from 26.8 percent in at station 3 to 38.9 percent at station 2 during the fall (Table 7). During the spring, percent scrapers were lowest at station 2 and highest at station 3 (values ranged from 12.3 to 18.4) (Table 8).

Table 7. Fall 2016 Macroinvertebrate Functional Feeding Group Percentages.

Stations	BIOREF Average	MFB1	MFB2	MFB3	MFB 4
Variables					
Filterer/Collector	12.7	17.6	19.5	19.2	19.4
Gatherer/Collector	35.7	29.8	36.6	29.6	29.3
Piercers	0.3	0.7	0.2	1.1	1.2
Predators	10.1	13.1	10.8	16.1	12.6
Scrapers	36.2	32.5	38.9	26.8	34.9
Shredders	5.0	4.9	4.8	7.3	2.7

Table 8. Spring 2017 Macroinvertebrate Functional Feeding Group Percentages.

Stations	BIOREF Average	MFB1	MFB2	MFB3	MFB4a	MFB4b
Variables						
Filterer/Collector	13.7	16.6	19.7	25.8	12.3	14.5
Gatherer/Collector	31.7	29.1	24.2	23.5	30.1	33.4
Piercers	0.4	2.7	4.1	1.5	2.7	2.0
Predators	13.7	15.4	12.9	13.0	16.6	11.1
Scrapers	25.5	17.1	12.3	18.4	14.3	13.7
Shredders	15.2	19.5	26.7	17.8	24.0	25.4

Percent Chironomidae

The percentage of Chironomidae is expected to increase with mining related activities (Poulton et al. 2010). Chironomidae percentages per station for each season are presented in Tables 5 and 6. During the fall, percent Chironomidae was highest at station 1 (28.9 percent). During the spring, percent Chironomidae was highest at station 2 (58.9 percent).

5.2.2 Biological Assessment QSIT

During the spring sampling season, macroinvertebrate duplicate samples were collected at Middle Fork Black River 4. These samples were analyzed for QSIT to determine whether they met the 70 percent threshold for duplicate samples (Rabeni et al. 1999, MoDNR 2012). The QSIT for these two samples was 75.6%.

5.3 Physicochemical Water Parameters

Discharge and *in situ* results are presented in Tables 9 and 10. Physicochemical values varied throughout the watershed for each season.

DO levels ranged from 7.88 mg/L to 8.53 mg/L during the fall sampling period. pH was within the WQS criterion range of 6-9, and specific conductance was higher at the upstream stations.

Table 9. Fall 2016 Discharge and *In Situ* Water Quality Measurements

Stations	MFB1	MFB2	MFB3	MFB4
Parameters				
Sampling time and date	1140h, 9-21	1430h, 9-21	0845h, 9-22	1130h, 9-22
Dissolved Oxygen (mg/L)	7.88	8.15	8.40	8.53
pH (su)	7.61	7.67	7.86	7.85
Specific Conductance (µS/cm)	333	345	437	509
Temperature (°C)	22.8	23.4	20.7	21.7
Turbidity (NTU)	<1	<1	1.4	<1
Discharge (cfs)	179.1	121.7	75.6	57.6

During the spring sampling season, DO levels ranged from 11.70 mg/L to 12.51 mg/L. pH values were consistent among the study stations, and all stations were within the WQS criterion range of 6-9. As in the fall, specific conductance was higher at the upstream stations. Turbidity values were comparable to the fall sampling. Discharge values were lower during the spring sampling period.

Table 10. Spring 2017 Discharge and *In Situ* Water Quality Measurements

Stations	MFB1	MFB2	MFB3	MFB4a	MFB4b
Parameters					
Sampling time and date	1000h, 3-15	1130h, 3-15	1245h, 3-15	1430h, 3-15	1435h, 3-15
Dissolved Oxygen (mg/L)	11.91	11.70	12.51	11.73	11.74
pH (su)	8.01	7.97	8.18	8.12	8.12
Specific Conductance (µS/cm)	362	375	420	490	490
Temperature (°C)	6.3	7.2	7.9	9.0	9.0
Turbidity (NTU)	<1	<1	<1	<1	<1
Discharge (cfs)	115.7	101.9	57.5	35.0	34.7

Currently, there are no nutrient criteria for Missouri streams and rivers. Nutrient values have been compared with those recommended by the U.S. EPA for Ecoregion 39, the Ozark Highlands. The recommended values are: 0.289 mg/L total nitrogen; 0.007 mg/L total phosphorus; and 1.42 NTU turbidity. Water chemistry concentrations are presented in Tables 9 and 10.

During the fall sampling season, total nitrogen exceeded U.S. EPA's recommended value at stations 3 and 4. Total phosphorus was below U.S. EPA's recommended value at all stations (Table 11). Turbidity values (reported in Table 9) ranged from <0.1 NTU to 1.4 NTU. U.S. EPA's recommended turbidity value is 1.42 NTU. Ammonia as N, sulfate, and chloride were within acceptable concentration ranges based on the WQS (MoDNR 2014); however, sulfate values were higher in the upstream stations.

Table 11. Fall 2016 Water Chemistry Concentrations

Stations	MFB1	MFB2	MFB3	MFB4
Parameters				
Sampling time and date	1140h, 9-21	1430h, 9-21	0845h, 9-22	1130h, 9-22
Nitrate+Nitrite as N (mg/L)	0.17	0.17	0.26	0.32
Total Nitrogen (mg/L)	0.18	0.19	0.30	0.35
Total Phosphorus (mg/L)	<0.01 ND	<0.01 ND	<0.01 ND	<0.01 ND
Ammonia as N (mg/L)	<0.03 ND	<0.03 ND	<0.03 ND	<0.03 ND
Sulfate (mg/L)	57.7	57.9	92.1	128
Chloride (mg/L)	5.99	6.19	9.59	11.2
Total Suspended Solids (mg/L)	<5 ND	<5 ND	<5 ND	<5 ND

ND not detected at reported value; values in bold exceed U.S. EPA recommendations (USEPA 2000).

During the spring sampling season, total nitrogen exceeded U.S. EPA's recommended value at all sampling stations (Table 12). Total phosphorus and turbidity (see Table 10 for turbidity values) were below U.S. EPA's recommended values. As was the case with fall samples, ammonia as N, sulfate, and chloride were within acceptable concentrations based on the WQS (MoDNR 2014), and sulfate was again higher at the upstream stations.

Table 12. Spring 2017 Water Chemistry Concentrations

Stations	MFB1	MFB2	MFB3	MFB4a	MFB4b
Parameters					
Sampling time and date	1000, 3-15	1130, 3-15	1245, 3-15	1430, 3-15	1435, 3-15
Nitrate+Nitrite as N (mg/L)	0.35	0.37	0.52	0.62	0.60
Total Nitrogen (mg/L)	0.38	0.37	0.48	0.62	0.61
Total Phosphorus (mg/L)	<0.01 ND	<0.01 ND	<0.01 ND	<0.01 ND	<0.01 ND
Ammonia as N (mg/L)	<0.03 ND	<0.03 ND	<0.03 ND	<0.03 ND	<0.03 ND
Sulfate (mg/L)	62.3	67.4	89.5	119	118
Chloride (mg/L)	7.74	7.91	9.78	12.0	12.2
Total Suspended Solids (mg/L)	<5 ND	<5 ND	<5 ND	<5 ND	<5 ND

ND not detected at reported value; values in bold exceed U.S. EPA recommendations (USEPA 2000).

Dissolved metals concentrations are presented in Tables 13 and 14. Based on calculations of the WQS criteria with the applicable hardness values, all dissolved metals were within criteria limits during both seasons. Dissolved nickel and zinc concentrations were higher at the upstream stations but still were within the WQS criteria limits.

Table 13. Fall 2016 Dissolved Metals Concentrations

Stations	MFB1	MFB2	MFB3	MFB4
Parameters				
Sampling time and date	1140h, 9-21	1430h, 9-21	0845h, 9-22	1130h, 9-22
Barium-Dissolved (µg/L)	45.9	43.0	45.1	41.9
Cadmium-Dissolved (µg/L)	<0.10 ND	<0.10 ND	<0.10 ND	<0.10 ND
Lead-Dissolved (µg/L)	<0.50 ND	<0.50 ND	<0.50 ND	<0.50 ND
Nickel-Dissolved (µg/L)	0.97*	1.40	3.39	5.79
Zinc-Dissolved (µg/L)	1.98	2.96	8.28	14.6
Calcium-Dissolved (mg/L)	30.3	29.5	36.9	41.6
Magnesium-Dissolved (mg/L)	19.2	19.1	24.9	28.9
Hardness as CaCO ₃ (mg/L)	155	152	195	223

ND not detected at reported value

* Estimated value, Detected below Practical Quantitation Limits

Table 14. Spring 2017 Dissolved Metals Concentrations

Stations	MFB1	MFB2	MFB3	MFB4a	MFB4b
Parameters					
Sampling time and date	1000, 3-15	1130, 3-15	1245, 3-15	1430, 3-15	1435, 3-15
Barium-Dissolved (µg/L)	35.3	33.2	32.9	31.6	31.3
Cadmium-Dissolved (µg/L)	<0.10 ND	<0.10 ND	<0.10 ND	<0.10 ND	<0.10 ND
Lead-Dissolved (µg/L)	<0.50 ND	<0.50 ND	<0.50 ND	<0.50 ND	<0.50 ND
Nickel-Dissolved (µg/L)	1.39	1.81	3.02	4.86	4.76
Zinc-Dissolved (µg/L)	2.02	3.42	6.34	17.8	10.3
Calcium-Dissolved (mg/L)	36.6	34.3	37.6	43.2	43.1
Magnesium-Dissolved (mg/L)	24.7	23.4	26.6	30.5	30.4
Hardness as CaCO ₃ (mg/L)	193	182	203	233	233

ND not detected at reported value

5.4 Sediment Analysis for Metals

During the fall sample season, sediment samples were collected using a #10 sized sieve to retain particles < 2 mm. The department judges a stream to be impaired when the sediment of the stream is greater than 150 percent of the PEC value. Nickel was elevated at the most upstream station, but it was not considered in exceedance of protection of aquatic life (Table 15).

Table 15. Fall 2016 Sieved Benthic Sediment Metals Concentrations

Stations	MFB1	MFB2	MFB3	MFB4	PEC	150% PEC
Parameters						
Sampling time and date	1200h, 9-21	1315h, 9-21	0940h, 9-22	1205h, 9-22	--	--
Arsenic µg/kg	5,290	3,880	5,410	5,890	33,000	49,500
Cadmium µg/kg	255	332	201	518	4,980	7,470
Copper µg/kg	14,900	13,200	10,100	16,300	149,000	223,500
Lead µg/kg	28,500	38,400	31,100	53,600	128,000	192,000
Nickel µg/kg	15,300	17,400	14,400	55,700	48,600	72,900
Zinc µg/kg	58,300	62,00	66,200	191,000	459,000	688,500

6.0 Discussion

6.1 Stream Habitat

Riffle quality was suboptimal at stations 2, 3, and 4; the stream was very wide, and the riffle length did not exceed two times the riffle width. Channel flow status was lower and sediment deposition was higher at station 2. Due to the lower channel flow status, less habitat (in particular, the rootmat habitat) was available to the macroinvertebrate community. Station 2 had an area along one bank that was reinforced with rip rap where the stream was starting to encroach on the adjacent county road. Station 2 differed the most from the control habitat assessment as well as from the remaining three stations. Although increased sediment deposition and suboptimal riffle quality may affect the macroinvertebrate community composition (Lemly 1982; Zweig and Rabeni 2001), it is likely the differences in habitat at the Middle Fork Black River stations did not negatively affect the macroinvertebrate community.

6.2 Biological Assessment and Macroinvertebrate Community Analysis

All stations had fully supporting MSCI scores during both sampling periods. The scores ranged from 16-20 during the fall sampling period and 18-20 during the spring sampling period. Station 4 scored optimally in all four metrics that compose the MSCI during both sampling seasons. The BI metric was developed for organic pollution and does not correspond with metals pollution (Lenat 1993). The additional metrics used by Poulton et al. (2010) to examine the response of macroinvertebrate communities to mining related disturbances showed no consistencies during the fall; station 1 had the highest ratio of tolerant/intolerant mayflies and the highest percent of Chironomidae. Station 2 had the highest percent of a single dominant taxon, and station 3 had the lowest percentage of scrapers. During the spring sampling, station 2 showed the greatest response to these metrics: highest tolerant/intolerant mayfly ratio, lowest percent scrapers, and highest percentage Chironomidae. Station 4a had the highest percentage of a single dominant taxon.

Clements et al. (1992) found that the net spinning caddisflies Hydropsychidae and Orthocladiinae chironomids were dominant at sites affected by heavy metals. Hydropsychidae were present at all stations during both seasons (Tables 5 and 6) in

greater abundance than the average of BIOREF data in aggregate. During the fall, net spinning caddisflies were three times higher than the BIOREF average at stations 2 and 4 but comparable to BIOREF data at station 1. During the spring, net spinning caddisflies were approximately six times higher than the BIOREF average at station 3 but only two to three times higher than the BIOREF data at the remaining stations. The family Chironomidae was not dominated by Orthocladiinae during the fall. During spring, the Orthocladiinae *Cricotopus/Orthocladius* was the most common Chironomidae collected at stations 1, 2, 3, and 4a. At station 4b, the tolerant Chironominae *Dicrotendipes* was the most common taxon collected, and *Cricotopus/Orthocladius* was the second most common taxon. In the spring, the percentages of *Cricotopus/Orthocladius* among sampling stations never exceeded twice that of the BIOREF average of 8.5 percent. However, it is not unusual in Missouri for *Cricotopus/Orthocladius* to be the most common taxon collected in the spring, whether in mining areas or not.

Heptageniid mayflies are sensitive to metals pollution (Clements et al. 2000). During the fall, six taxa of Heptageniidae were collected from stations 1 and 2, and five taxa were collected at stations 3 and 4. During the spring, the number of heptageniid taxa collected ranged from three to seven; three taxa collected from stations 2 and 4a, five taxa collected from station 1, and seven taxa were collected from stations 3 and 4a. Taxa included (but not all inclusive) *Leucrocuta*, *Maccaffertium bednariki*, *M. mediopunctatum*, *M. pulchellum*, *M. terminatum*, *Rhithrogena*, *Stenacron*, and *Stenonema femoratum*. Examining the occurrence of heptageniid mayflies to determine metals toxicity impairments in the Middle Fork Black River is inconclusive in this study. During the fall, the highest percentage (13.3 percent) of heptageniid mayflies occurred at the most upstream station, Station 4, which is located just downstream of Strother Creek, a tributary directly affected by mining activities of the Viburnum Trend. Heptageniidae was the second most common family collected from station 4 during the fall and the third most common family collected at station 3 during the spring. Although abundance of the family varied during the seasons, heptageniids were commonly collected at all stations.

The invertebrate biomass in Ozark Streams is dominated by crayfish (Rabeni et al. 1995). *Faxonius hylas* is endemic to Missouri and is the most abundant crayfish in the Black River watershed (Pflieger 1996). Crayfish samples collected from riffle habitats at several sites affected by Viburnum Trend mining activities (including Strother Creek and Middle Fork Black River) revealed lower densities of crayfish when compared to reference sites (Allert et al. 2008). Allert et al. (2008) also compared metals concentrations of whole crayfish (*F. hylas*) between sites affected by mining and reference sites, which revealed metals concentrations in *F. hylas* tissues were 8-10 fold higher at mining sites than at reference sites. The results from this bioassessment affirmed low densities of crayfish in the Middle Fork Black River. During the fall, *F. hylas* was collected at three of the four stations but not in high abundance, and a single *F. punctimanus* individual was collected at station 4. During the spring, *F. hylas* was collected at stations 1, 2, and 4, again in low abundance. During both seasons, crayfish taxa were identified in the large/rare portion of sample processing, which is notated as present/absent versus tallying a number of

specimens. However, during the sampling processing, it was noted that fewer than 10 individuals were recorded per station. Crayfish abundance and taxa richness were similar among MFBR and BIOREF fall samples. Spring BIOREF samples, however, tended to have slightly greater numbers of crayfish taxa, and more individuals were present compared to MFBR samples.

6.3 Physicochemical Water Parameters and Dissolved Metals

The physicochemical water parameters and nutrient values were within acceptable ranges with the exception of nitrogen, which was elevated at two stations during the fall and all stations during the spring. Although sulfate was not in exceedance of the acute or chronic standard, it was higher at the upstream stations, presumably due to mining activities in the watershed. Chloride and specific conductance were also higher at the upstream stations. Allert et al. (2008) found sulfate, hardness, conductivity, and nitrogen ions to be higher downstream of mining areas when compared to reference sites, and these variables may be useful in determining the downstream extent of the effects of the pollutants.

Dissolved nickel and dissolved zinc were elevated at the upstream stations during both sampling seasons but did not exceed the acute or chronic criteria. Aquatic organisms are exposed to dissolved metals through absorption to or uptake across the gills. Dissolved metals are typically more toxic to aquatic organisms than particulate forms. Metals can affect aquatic organisms in water and in sediment (Rainbow 1996, Maret et al. 2003)

6.4 Sediment Analysis for Metals

Although nickel exceeded the PEC value at station 4, it was not greater than 150 percent of the PEC. The department judges a stream to be impaired when stream benthic sediment metals concentrations are greater than 150 percent of the PEC. Nickel was below the PEC at the remaining stations. All other metals analyzed were also below the PEC values at all stations.

7.0 Summary

Tests of the null hypotheses resulted in the following conclusions:

- 1) Stream habitat assessment scores of Middle Fork Black River study sites will be similar to those of Sinking Creek, a BIOREF station located in the Ozark/Black/Current EDU. This hypothesis is accepted. The SHAPP scores of the study stations all scored >75% of the SHAPP control stream.
- 2) The macroinvertebrate community in Middle Fork Black River will be similar to the macroinvertebrate community of BIOREF streams in the Ozark/Black/Current EDU. This hypothesis is accepted. All stations attained fully supporting status during both seasons with scores ranging from 16-20 in the fall and 18-20 in the spring.
- 3) Physicochemical water quality of Middle Fork Black River will meet the WQS and meet U.S. EPA's recommended nutrient guidelines. This hypothesis is accepted for all

parameters except total nitrogen. Total nitrogen exceeded U.S. EPA's suggested concentration at two station during the fall and all stations during the spring. Dissolved metals were not in exceedance of WQS during the sampling periods.

4) Metals toxicity values of sediment samples collected from Middle Fork Black River will meet recommended PEC values calculated by MacDonald et al. (2000). This hypothesis is accepted. Although nickel was elevated at station 4, it was not greater than 150 percent of the PEC value, the impairment threshold.

8.0 Conclusion

Metals have been extensively mined in the last century in the Interior Highlands of the central US, a portion including the Ozark Plateau in Missouri (Poulton et al. 2010). Although the MSCI scores indicate a fully supporting biological community during both seasons, some stations with MSCI scores of 16 during the fall, as well as some of the additional metrics and community analysis during both seasons, indicate room for improvement. Additional metrics used by Poulton et al. (2010) were inconclusive during the fall, but during the spring, station 2 showed evidence of being affected based on these additional metrics. Hydropsychidae, which have been shown to be tolerant of metals pollution (Clements et al. 1992), thrive in Middle Fork Black River. Our findings concur with findings by Allert et al. (2008) of decreased *F. hylas* in metals affected streams, which was observed in the spring season. Over time, new technologies have been developed to better streamline and improve the mining process and treatment of wastes (Poulton et al. 2010), and mines are operating with stricter environmental controls.

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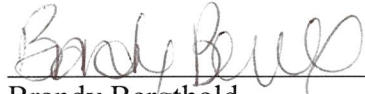
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Submitted by:



Brandy Bergthold
Environmental Specialist III
Water Quality Monitoring Section
Environmental Services Program

Date:



Approved by:



Lynn Milberg
Water Quality Monitoring Section Chief
Environmental Services Program

LM:bbh

c: Robert Voss, WPP
Art Goodin, SERO

Appendix A

Invertebrate Database Bench Sheet Report Fall 2016 and Spring 2017;
Middle Fork Black River, Reynolds County
Grouped by Season and Station

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16109], Station #1, Sample Date: 9/21/2016 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	15	1	3
AMPHIPODA			
Hyalella azteca	1		9
BASOMMATOPHORA			
Physella	1		
COLEOPTERA			
Ancyronyx variegatus			1
Dubiraphia		5	27
Macronychus glabratus			2
Microcylloepus pusillus			1
Optioservus sandersoni	79		
Psephenus herricki	3	3	
Stenelmis	190	51	3
DIPTERA			
Ablabesmyia		12	10
Chironomidae		1	
Cladotanytarsus	5	28	
Cricotopus bicinctus	2		10
Cricotopus/Orthocladius	5	1	8
Cryptochironomus	2	1	
Dicrotendipes		1	6
Forcipomyiinae	1		
Hemerodromia	2		
Hexatoma	2	9	
Labrundinia			16
Micropsectra	2		
Microtendipes	20	3	
Muscidae	1		
Parametriocnemus	2		
Paratanytarsus			31
Phaenopsectra		2	
Polypedilum flavum	33		
Potthastia	1	1	
Pseudochironomus		1	
Rheotanytarsus	32		14
Robackia	5		
Saetheria		2	
Stempellina		1	
Stempellinella	5	13	
Tanytarsus	29	35	11
Thienemanniella	3	1	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16109], Station #1, Sample Date: 9/21/2016 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.	4	3	6
Tipula			1
Zavrelimyia	2		
EPHEMEROPTERA			
Acentrella	22		
Baetis	65		
Caenis anceps	4	6	
Caenis latipennis	4	44	31
Centroptilum			47
Eurylophella			1
Heptageniidae	6		1
Isonychia bicolor	19	1	
Leucrocuta	2		
Maccaffertium bednariki	7		
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	6		
Plauditus	4	2	
Procloeon		3	5
Stenacron	2	1	1
Stenonema femoratum		16	1
Tricorythodes	42	7	22
LUMBRICINA			
Lumbricina		1	
MEGALOPTERA			
Corydalus	1		
ODONATA			
Calopteryx			1
Enallagma			6
Hagenius brevistylus		1	-99
Helocordulia			-99
Hetaerina			1
Stylogomphus albistylus		-99	
PLECOPTERA			
Acroneuria		1	
Chloroperlidae	2		
Leuctra		1	1
Neoperla	11	1	
Pteronarcys pictetii	-99		
TRICHOPTERA			
Agapetus		1	2
Ceratopsyche morosa grp	4		
Cheumatopsyche	47	4	
Chimarra	4	2	
Hydroptila	2	2	2
Oecetis	2		20

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16109], Station #1, Sample Date: 9/21/2016 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polycentropus	1		1
Triaenodes			1
TUBIFICIDA			
Limnodrilus hoffmeisteri		1	
Tubificidae		1	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16110], Station #2, Sample Date: 9/21/2016 2:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	2	
AMPHIPODA			
Allocrangonyx		3	
Crangonyx		2	
Hyalella azteca			4
BASOMMATOPHORA			
Physella			1
COLEOPTERA			
Berosus		1	
Dineutus			-99
Dubiraphia		4	25
Ectopria nervosa	1		
Helichus lithophilus		1	1
Macronychus glabratus			3
Microcylloepus pusillus	1	1	7
Optioservus sandersoni	54	9	7
Psephenus herricki	9	4	
Stenelmis	262	36	3
DECAPODA			
Faxonius hylas	1		
DIPTERA			
Ablabesmyia		37	2
Atherix	1		
Cardiocladius			1
Ceratopogoninae		2	1
Chironomidae		6	7
Chrysops		1	
Cladotanytarsus		8	1
Cricotopus bicinctus	2		18
Cricotopus/Orthocladius	1	2	3
Dicrotendipes		4	2
Diptera		1	
Hemerodromia	4	1	
Labrundinia		1	3
Nanocladius		1	
Nilothauma		1	
Ormosia		1	
Paratanytarsus		2	6
Phaenopsectra		3	
Polypedilum aviceps	1		
Polypedilum flavum	8	3	1
Potthastia		1	
Pseudosmittia			1
Rheotanytarsus	5		27

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16110], Station #2, Sample Date: 9/21/2016 2:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Simulium	1		
Stempellinella		3	
Tabanus	1	2	
Tanytarsus	4	14	6
Thienemanniella		1	2
Thienemannimyia grp.		7	7
Tipula		1	1
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	11		
Baetis	42		
Caenis anceps	4	1	2
Caenis latipennis		15	15
Centroptilum			3
Ephemerella	2		
Eurylophella		2	7
Isonychia bicolor	35		4
Leptophlebiidae		6	
Maccaffertium bednariki	5		
Maccaffertium mediopunctatum	7		
Maccaffertium pulchellum	4	3	3
Maccaffertium vicarium		1	
Plauditus	1		
Procloeon		9	2
Pseudocloeon			1
Stenacron		4	
Stenonema femoratum		39	
Tricorythodes	10	16	10
ISOPODA			
Caecidotea (Blind & Unpigmented)	4		
LUMBRICINA			
Lumbricina	-99		
MEGALOPTERA			
Corydalus	2		-99
ODONATA			
Boyeria			-99
Calopteryx			3
Enallagma			2
Gomphidae	1		
Hagenius brevistylus		4	-99
Hetaerina			5
Macromia		-99	
Stylogomphus albistylus		-99	
PLECOPTERA			

Aquad Invertebrate Database Bench Sheet Report

Middle Fk Black R [16110], Station #2, Sample Date: 9/21/2016 2:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Perlesta	1		
TRICHOPTERA			
Agapetus	1		
Ceratopsyche morosa grp	6		1
Cheumatopsyche	87		39
Chimarra	7	1	
Helicopsyche	13	1	
Lepidostoma	1		
Nectopsyche		1	
Oecetis		1	61
Oxyethira			1
Polycentropus		2	1
Triaenodes			15
TRICLADIDA			
Planariidae	20	1	1

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16111], Station #3, Sample Date: 9/22/2016 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	12	4	
AMPHIPODA			
Hyalella azteca		1	33
BASOMMATOPHORA			
Ancylidae		2	
COLEOPTERA			
Ancyronyx variegatus			2
Dubiraphia		8	19
Ectopria nervosa			1
Microcylloepus pusillus		3	8
Optioservus sandersoni	29	20	1
Paracymus	11		
Psephenus herricki	9	5	
Stenelmis	82	36	2
DECAPODA			
Faxonius hylas	-99		
DIPTERA			
Ablabesmyia	3	21	2
Anopheles			1
Cardiocladius	1		
Ceratopogoninae		1	
Chironomidae		1	
Cladotanytarsus		6	
Corynoneura	1		
Cricotopus bicinctus			8
Cricotopus/Orthocladius	11	3	9
Cryptochironomus		1	
Dicrotendipes		5	3
Eukiefferiella	1		
Forcipomyiinae			1
Hemerodromia	4	2	
Hexatoma		5	
Labrundinia		4	5
Larsia			1
Microtendipes	1		
Nanocladius		1	
Nilotanypus			1
Parakiefferiella	1	4	
Paratanytarsus		1	3
Pentaneura			3
Phaenopsectra		8	
Polypedilum aviceps	2		
Polypedilum flavum	27		
Polypedilum illinoense grp			4

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16111], Station #3, Sample Date: 9/22/2016 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pseudochironomus		3	
Rheotanytarsus	46	7	25
Simulium	1		
Stempellinella	1	2	
Tabanus	1		
Tanytarsus	10	8	7
Thienemanniella	14	4	1
Thienemannimyia grp.	14	7	7
EPHEMEROPTERA			
Acentrella	8		2
Acerpenna	1		
Baetis	49	1	
Caenis anceps	6	2	
Caenis latipennis	4	56	31
Centroptilum			11
Eurylophella enoensis		2	8
Isonychia bicolor	47		
Leptophlebiidae		5	1
Leucrocuta	10	5	
Maccaffertium mediopunctatum	28		
Maccaffertium pulchellum	13	2	2
Plauditus	2		1
Procloeon		3	7
Stenacron	18	4	
Stenonema femoratum	3	24	2
Tricorythodes	10	5	13
HEMIPTERA			
Microvelia			1
LUMBRICULIDA			
Lumbriculidae		1	
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	4	5	1
Basiaeschna janata			-99
Calopteryx			6
Enallagma			4
Gomphidae	-99	3	1
Hagenius brevistylus		6	
Macromia			2
Neurocordulia			-99
Stylogomphus albistylus		1	
PLECOPTERA			
Neoperla	1		
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16111], Station #3, Sample Date: 9/22/2016 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ceratopsyche morosa grp	14		2
Cheumatopsyche	68		1
Helicopsyche	22	1	2
Hydroptila	2	1	
Lepidostoma	1		
Mystacides		1	
Oecetis	2	2	48
Oxyethira			10
Trienodes		2	23
TRICLADIDA			
Planariidae	6	1	1
TUBIFICIDA			
Branchiura sowerbyi		1	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16112], Station #4, Sample Date: 9/22/2016 11:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	7	
AMPHIPODA			
Hyalella azteca			23
COLEOPTERA			
Dubiraphia		4	30
Ectopria nervosa		3	1
Lutrochus	1		
Macronychus glabratus		2	
Microcyloopus pusillus	1		36
Optioservus sandersoni	61	27	5
Paracymus	1		
Psephenus herricki	11	9	
Stenelmis	109	24	1
DECAPODA			
Faxonius hylas		-99	
Faxonius punctimanus			1
DIPTERA			
Ablabesmyia		32	3
Chironomidae		1	
Cladotanytarsus		4	2
Corynoneura			2
Cricotopus bicinctus		1	1
Cricotopus/Orthocladius	5	4	7
Cryptochironomus	1	1	
Dicrotendipes		3	1
Hemerodromia	9		
Hexatoma	4		
Labrundinia		1	2
Nemotelus	-99		
Parachaetocladius	1		
Parakiefferiella			1
Parametriocnemus	4		
Paratanytarsus			2
Pentaneura	4		2
Phaenopsectra		1	
Polypedilum aviceps	1		
Polypedilum flavum	3		1
Psectrocladius			1
Pseudochironomus		1	
Rheocricotopus	1		
Rheotanytarsus	23		10
Stempellinella	2	1	1
Tabanus	-99		
Tanytarsus	1	2	5

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16112], Station #4, Sample Date: 9/22/2016 11:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemanniella			2
Thienemannimyia grp.		7	4
EPHEMEROPTERA			
Acentrella	5		1
Baetis	50		
Caenis anceps	4	7	4
Caenis latipennis		41	41
Eurylophella	1	3	16
Isonychia bicolor	53		2
Leucrocuta		2	
Maccaffertium mediopunctatum	19	2	3
Maccaffertium pulchellum	68	1	
Paraleptophlebia		9	2
Plauditus	3	1	1
Procloeon		2	
Pseudocloeon			2
Stenacron		22	
Stenonema femoratum		55	
Tricorythodes	21	6	11
LUMBRICINA			
Lumbricina		2	
MEGALOPTERA			
Corydalus	1		
Nigronia serricornis	-99		1
NEOTAENIOGLOSSA			
Elimia	1		-99
ODONATA			
Argia		4	
Calopteryx			2
Enallagma			3
Gomphidae	1		
Hagenius brevistylus		5	2
Hetaerina			7
Ischnura			1
Macromia		-99	2
Stylogomphus albistylus	-99	6	1
PLECOPTERA			
Leuctra	2		
Perlidae	1		
TRICHOPTERA			
Agapetus	7		
Ceratopsyche morosa grp	12		1
Cheumatopsyche	132		2
Chimarra	7		
Helicopsyche	15	1	2

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [16112], Station #4, Sample Date: 9/22/2016 11:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hydroptila	2		1
Nectopsyche		3	
Oecetis	3	2	38
Oxyethira			12
Polycentropus		1	1
Setodes	3		
Trienodes			6
TRICLADIDA			
Planariidae	10	3	1
TUBIFICIDA			
Tubificidae			1

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17065], Station #1, Sample Date: 3/15/2017 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	30	3	3
AMPHIPODA			
Hyalella azteca			3
BASOMMATOPHORA			
Menetus			4
Physella			1
COLEOPTERA			
Ancyronyx variegatus			1
Dubiraphia		1	1
Optioservus sandersoni	67	1	2
Stenelmis	47	10	2
DECAPODA			
Faxonius hylas	-99		
DIPTERA			
Ablabesmyia		14	1
Cardiocladius	14		
Ceratopogoninae	1	5	
Chironomidae		1	
Cladotanytarsus	1	34	4
Clinocera	1		
Corynoneura		10	1
Cricotopus bicinctus	13	6	46
Cricotopus/Orthocladius	60	41	59
Cryptochironomus		11	1
Dicrotendipes		26	25
Ephydriidae			1
Eukiefferiella	5	1	5
Hemerodromia	14	2	
Hexatoma		1	
Labrundinia		2	2
Larsia			2
Microtendipes	2	3	1
Nilothauma		9	
Paracladopelma		1	
Parakiefferiella		16	5
Parametriocnemus	1		
Paratanytarsus		1	15
Phaenopsectra		10	5
Polypedilum flavum	3		
Polypedilum scalaenum grp		5	
Potthastia	4	3	3
Prosimulium	1		
Rheotanytarsus	15		15
Simulium	4		1

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17065], Station #1, Sample Date: 3/15/2017 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stempellinella	14	40	6
Stictochironomus		1	
Sublettea	1	1	
Sympotthastia			1
Synorthocladius	1		
Tabanus	-99		
Tanytarsus	23	49	10
Thienemannimyia grp.	28	21	9
EPHEMEROPTERA			
Acentrella	5		
Caenis latipennis		2	6
Ephemerella invaria	84		5
Eurylophella bicolor	4	6	
Eurylophella enoensis			1
Isonychia bicolor	14		
Maccaffertium bednariki	16	4	
Maccaffertium mediopunctatum	12		
Paraleptophlebia		1	
Rhithrogena	24		
Serratella serratoides	1		
Siphonurus	1		19
Stenacron		1	
Stenonema femoratum		11	-99
LUMBRICINA			
Lumbricina	1		
MEGALOPTERA			
Corydalus	-99		-99
NEOTAENIOGLOSSA			
Elimia			1
ODONATA			
Boyeria			-99
Hagenius brevistylus		1	
Hetaerina			-99
PLECOPTERA			
Acroneuria	7		2
Amphinemura	3		
Leuctridae	2	5	
Neoperla	4		2
Prostoia	6		1
Pteronarcys pictetii	1		-99
TRICHOPTERA			
Agapetus	1		
Ceratopsyche morosa grp	8		
Cheumatopsyche	67	1	1
Chimarra	2		

Aquad Invertebrate Database Bench Sheet Report

Middle Fk Black R [17065], Station #1, Sample Date: 3/15/2017 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Helicopsyche	5		2
Hydroptila	10	11	7
Lepidostoma	1		1
Mystacides		1	1
Oecetis	3		16
Oxyethira			7
Polycentropus		2	1
Pycnopsyche			-99
Rhyacophila	1		
TRICLADIDA			
Planariidae	5		

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17066], Station #2, Sample Date: 3/15/2017 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	6	1
AMPHIPODA			
Hyalella azteca			15
BASOMMATOPHORA			
Menetus		1	1
Physella			2
COLEOPTERA			
Dineutus			-99
Dubiraphia		2	8
Ectopria nervosa		1	
Gyrinus			1
Helichus lithophilus			1
Optioservus sandersoni	68	5	2
Stenelmis	26	5	
DECAPODA			
Faxonius hylas		-99	
DIPTERA			
Ablabesmyia		11	1
Antocha	1		
Cardiocladius	22		
Ceratopogoninae		12	1
Chironomidae	3	4	7
Cladotanytarsus		8	1
Clinocera	3		
Corynoneura		5	
Cricotopus bicinctus	16	2	44
Cricotopus/Orthocladius	77	45	89
Cryptochironomus		10	
Dicrotendipes		26	12
Eukiefferiella	36		
Hemerodromia	19	7	
Hexatoma	1		
Labrundinia			7
Larsia		1	
Micropsectra		1	
Microtendipes	4	19	1
Parakiefferiella		24	13
Parametriocnemus	3		
Paratanytarsus		1	18
Phaenopsectra		2	
Polypedilum aviceps	7		
Polypedilum flavum	31	1	
Potthastia	1	7	4
Prosimulium	1		

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17066], Station #2, Sample Date: 3/15/2017 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheocricotopus	1		
Rheotanytarsus	19		21
Simulium	6		
Stempellinella	21	27	
Sublettea			1
Sympotthastia		1	3
Synorthocladus	1		1
Tabanus	-99		
Tanytarsus	17	51	24
Thienemannimyia grp.	14	26	3
Tipula	-99		
EPHEMEROPTERA			
Acentrella	1		
Baetis	1		
Caenis latipennis	1	5	3
Ephemerella invaria	16	2	
Eurylophella bicolor	2	6	
Eurylophella enoensis			3
Isonychia bicolor	26		
Maccaffertium mediopunctatum	7	2	
Maccaffertium pulchellum	6		
Paraleptophlebia		1	
Siphonurus			9
Stenonema femoratum		6	1
Teloganopsis deficiens	5		
MEGALOPTERA			
Corydalus	1		-99
NEOTAENIOGLOSSA			
Elimia			-99
ODONATA			
Argia		1	
Basiaeschna janata			1
Boyeria			1
Enallagma			2
Hagenius brevistylus			-99
Helocordulia			-99
Macromia		-99	
PLECOPTERA			
Agnetina flavescens	-99		
Amphinemura	7		
Helopicus nalatus	-99		
Isoperla	1		
Leuctridae	2	26	
Perlesta	3		
Perlinella drymo		1	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17066], Station #2, Sample Date: 3/15/2017 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Protoia	3		
Pteronarcys pictetii	1		
Strophopteryx fasciata	1		
TRICHOPTERA			
Agapetus	1		
Ceratopsyche morosa grp	14		
Cheumatopsyche	56		
Chimarra	1		
Helicopsyche	7	1	17
Hydroptila	4	35	11
Lepidostoma	2		1
Mystacides			2
Oecetis			4
Oxyethira			5
Polycentropodidae			1
Pycnopsyche			-99
Rhyacophila	1		
Setodes	1		
Triaenodes			1
TRICLADIDA			
Planariidae	7	2	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17067], Station #3, Sample Date: 3/15/2017 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	1	2
AMPHIPODA			
Crangonyx			2
Hyalella azteca			20
BASOMMATOPHORA			
Menetus		2	
Physella		1	
COLEOPTERA			
Ancyronyx variegatus		1	
Berosus		2	
Dubiraphia		9	7
Microcylloepus pusillus			1
Optioservus sandersoni	70	4	
Psephenus herricki	1	1	-99
Stenelmis	11	1	
DIPTERA			
Ablabesmyia		45	4
Antocha	1		
Atherix	2		
Cardiocladius	9		
Ceratopogoninae		2	1
Chrysops			-99
Cladotanytarsus		14	2
Clinocera	1		
Corynoneura			1
Cricotopus bicinctus			2
Cricotopus/Orthocladius	39	18	116
Cryptochironomus	1	3	
Dicrotendipes		59	30
Eukiefferiella	16		2
Hemerodromia	20	1	1
Labrundinia		1	2
Lauterborniella		1	
Micropsectra	1		1
Microtendipes	4	2	
Parakiefferiella		2	4
Parametrioctenemus	1		
Paratanytarsus		3	28
Pentaneura	2		
Phaenopsectra	2	4	4
Polypedilum aviceps	4		
Polypedilum flavum	8		
Polypedilum illinoense grp			2
Potthastia		3	1

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17067], Station #3, Sample Date: 3/15/2017 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Prosimulium	2		
Rheocricotopus	1		1
Rheotanytarsus	35		23
Simulium	3		
Stempellinella	2	5	
Stictochironomus		1	
Sympotthastia			3
Synorthocladius	1		
Tabanus	1		
Tanytarsus	9	12	34
Thienemanniella			1
Thienemannimyia grp.	14	15	5
Tipula	1		
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	11		
Acerpenna	1		
Caenis latipennis		16	2
Ephemerella invaria	10		
Eurylophella bicolor	3	6	2
Isonychia bicolor	72	1	3
Leptophlebia		3	4
Leucrocuta	1		
Maccaffertium bednariki	6		
Maccaffertium mediopunctatum	53	-99	
Maccaffertium pulchellum	37		1
Maccaffertium terminatum	1		
Siphonurus		1	11
Stenacron	4	2	
Stenonema femoratum	3	33	6
Teloganopsis deficiens	17		1
Tricorythodes	3		
ISOPODA			
Caecidotea			5
LUMBRICINA			
Lumbricina	-99		
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	1	3	-99
Boyeria			-99
Enallagma			1
Gomphidae	2	1	
Hagenius brevistylus		2	
Helocordulia			-99

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17067], Station #3, Sample Date: 3/15/2017 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hetaerina			2
Macromia			-99
PLECOPTERA			
Amphinemura	19		11
Chloroperlidae		1	
Isoperla	-99		
Leuctridae	13	14	1
Perlinella drymo		-99	-99
Prostoia	1		2
TRICHOPTERA			
Ceratopsyche morosa grp	33		2
Cheumatopsyche	131		4
Helicopsyche	10	2	4
Hydroptila	2		5
Lepidostoma	2		
Mystacides		1	
Nectopsyche	1		
Oecetis	2		18
Oxyethira		1	11
Polycentropus		-99	1
Pycnopsyche			-99
Rhyacophila	6		1
Triaenodes			2
TRICLADIDA			
Planariidae	12		1
TUBIFICIDA			
Tubificidae		2	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17068], Station #4a, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	44	5	
AMPHIPODA			
Hyalella azteca			12
BASOMMATOPHORA			
Lymnaeidae			1
COLEOPTERA			
Ancyronyx variegatus			1
Dubiraphia		1	
Enochrus			-99
Helichus lithophilus			1
Microcylloepus pusillus			4
Optioservus sandersoni	47	9	
Psephenus herricki	1	-99	
Stenelmis	9		
DECAPODA			
Faxonius hylas			-99
DIPTERA			
Ablabesmyia		16	2
Antocha	3		2
Cardiocladius	5		
Ceratopogoninae		6	
Chironomidae			1
Chrysops	-99		-99
Cladotanytarsus		6	
Corynoneura	1		1
Cricotopus bicinctus	8	4	5
Cricotopus trifascia	7		3
Cricotopus/Orthocladius	57	53	97
Cryptochironomus		1	
Dicrotendipes		20	58
Eukiefferiella	10		
Eukiefferiella devonica grp	1		
Hemerodromia	28		1
Hexatoma	8		
Labrundinia			11
Micropsectra	4	2	
Microtendipes		5	
Parakiefferiella		58	19
Parametriocnemus	4		
Paratanytarsus			9
Pentaneura	2	4	5
Phaenopsectra		6	
Polypedilum aviceps	4		
Polypedilum flavum	2		

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17068], Station #4a, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Potthastia		6	
Psectrocladius		1	1
Pseudochironomus		1	
Rheocricotopus	7		
Rheotanytarsus	10		8
Simulium	2		
Stempellinella	8	10	1
Sympotthastia		1	
Tabanus			-99
Tanytarsus	6	16	14
Thienemanniella	3		
Thienemannimyia grp.	20	23	6
Tipula	-99		
Tvetenia bavarica grp	1		
EPHEMEROPTERA			
Acentrella	48		
Caenis latipennis	2	14	
Ephemerella	6		
Eurylophella bicolor	2		6
Heptageniidae	5	1	
Isonychia bicolor	35		
Leptophlebia			-99
Maccaffertium mediopunctatum	43		-99
Maccaffertium pulchellum	15		
Paracloeodes			1
Stenonema femoratum		4	
Teloganopsis deficiens	3		
Tricorythodes	9		
GORDIOIDEA			
Chordodidae	-99		
LUMBRICINA			
Lumbricina	1		
MEGALOPTERA			
Corydalus	-99		
Nigronia serricornis			-99
ODONATA			
Argia		2	1
Arigomphus			-99
Boyeria			1
Calopteryx			-99
Gomphidae	1	1	
Hagenius brevistylus		1	
PLECOPTERA			
Amphinemura	6		
Helopicus nalatus	-99		

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17068], Station #4a, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Isoperla	3	2	
Leuctridae	22	31	
Strophopteryx fasciata	3		
TRICHOPTERA			
Ceratopsyche morosa grp	8		
Cheumatopsyche	45		1
Chimarra	1	1	
Glossosomatidae	4		
Helicopsyche	10		19
Hydropsyche	2		
Hydropsychidae	1		
Hydroptila	11	19	4
Lepidostoma	2	1	
Mystacides			8
Oecetis	4	4	
Psychomyia			1
Pycnopsyche			-99
Rhyacophila	1		
Setodes	6		
TRICLADIDA			
Planariidae	13	1	
TUBIFICIDA			
Tubificidae		1	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17069], Station #4b, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	16	8	
AMPHIPODA			
Hyalella azteca			9
COLEOPTERA			
Dubiraphia		1	1
Ectopria nervosa			1
Microcyloepus pusillus	1		1
Optioservus sandersoni	43	8	
Psephenus herricki	1		
Stenelmis	2	2	
DECAPODA			
Faxonius hylas		-99	
DIPTERA			
Ablabesmyia		14	
Antocha	3		
Atherix	-99		
Cardiocladius	3		
Ceratopogoninae	2	4	
Chironomidae	1	1	1
Chrysops		-99	
Cladotanytarsus		2	
Clinocera			1
Corynoneura			2
Cricotopus bicinctus	10	5	13
Cricotopus trifascia	10		1
Cricotopus/Orthocladius	61	60	58
Cryptochironomus		1	
Dicrotendipes		20	174
Eukiefferiella	22		1
Hemerodromia	22	5	
Hexatoma		1	
Labrundinia		2	6
Microtendipes	7	4	
Orthocladius (Euorthocladius)	3		
Parakiefferiella		50	8
Parametriocnemus	9	1	
Paratanytarsus			8
Pentaneura	1	2	
Phaenopsectra		8	
Polypedilum aviceps	15		
Polypedilum flavum	23		
Polypedilum illinoense grp			1
Potthastia		5	
Prosimulium	2		

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17069], Station #4b, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheocricotopus	6		
Rheotanytarsus	33	1	6
Simulium	4		
Stempellinella	6	7	
Stenochironomus		1	
Stictochironomus		1	
Sympotthastia		1	
Tabanus	-99		
Tanytarsus	9	27	9
Thienemanniella	2	1	
Thienemannimyia grp.	16	18	9
Tipula	-99		
Tvetenia bavarica grp	1		
Zavrelinmyia		2	
EPHEMEROPTERA			
Acentrella	33		
Acerpenna	4		
Baetisca lacustris		1	
Caenis latipennis		5	1
Ephemerella invaria	1		
Ephemerella subvaria	1		
Eurylophella bicolor		2	
Eurylophella enoensis			3
Isonychia bicolor	46		-99
Leptophlebia		4	
Leucrocuta	2		
Maccaffertium bednariki	2		
Maccaffertium mediopunctatum	48	1	
Maccaffertium pulchellum	8	2	
Maccaffertium terminatum	4		-99
Siphonurus			1
Stenacron	1	4	
Stenonema femoratum		12	
Teloganopsis deficiens	6		
Tricorythodes	4		
LUMBRICINA			
Lumbricina		-99	
MEGALOPTERA			
Nigronia serricornis	-99		
NEOTAENIOGLOSSA			
Elimia			1
ODONATA			
Argia		2	
Enallagma			-99
Hagenius brevistylus		-99	

Aquid Invertebrate Database Bench Sheet Report

Middle Fk Black R [17069], Station #4b, Sample Date: 3/15/2017 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stylogomphus albistylus		-99	
PLECOPTERA			
Amphinemura	19		1
Helopicus nalatus	1		
Leuctridae	20	30	
Neoperla	-99		
Perlesta			1
Prostoia	3		1
TRICHOPTERA			
Agapetus	5		
Ceratopsyche	1		
Ceratopsyche morosa grp	12		
Cheumatopsyche	27	1	
Chimarra	1		
Helicopsyche	10	2	12
Hydroptila	6	11	6
Lepidostoma	2		
Mystacides		3	1
Oecetis	4		
Oxyethira			3
Polycentropus	2	1	1
Psychomyia	4		
Setodes	1		
TRICLADIDA			
Planariidae	13		